REMARKS

Claims 1 and 5-29 are presently pending in the application. Claim 4 has been cancelled and Claims 1, 22, 23 and 27-29 have been amended. No new matter has been added and support for the amendments to the claims can be found in the specification and drawings. In view of the above claim amendments and arguments presented hereinbelow, Applicants respectfully submit that these claims are now in condition for allowance.

Claim Rejections – 35 U.S.C. § 103(a)

Claims 1, 4 (cancelled), 6-9, 12-14, 16, 17, 19, 23, 25 and 26 stand rejected under Section 103(a) as being unpatentable over by Saito (JP0405153052) ("Saito") in view of Naito et al. (European Patent Office Publication No. 409260) ("Naito"). Applicants respectfully traverse this rejection and submit that the combination of Saito and Naito fails to disclose or suggest the claimed invention.

Claim 1, as amended, calls for a method for receiving an optical double sideband signal over an optical fiber system, comprising the steps of:

> splitting the received optical double sideband signal into an upper sideband signal and a lower sideband signal;
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> photodetecting *and adaptively equalizing* said upper sideband;
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> photodetecting *and adaptively equalizing* said lower sideband;
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> compensating said photodetected and adaptively equalized upper sideband signal for chromatic dispersion and polarization mode dispersion;
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> compensating said photodetected and adaptively equalized lower sideband signal for chromatic dispersion and polarization mode dispersion;
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> combining said dispersion compensated upper sideband signal with said dispersion compensated lower sideband signal[.];

detecting a bit error rate of the resulting combined signal; and

adjusting the adaptive equalizing according to the bit error rate. Emphasis added.

Saito discloses a method of performing waveform-equalization on an upper and lower sideband in an optical communications system. Specifically, Saito discloses:

> The optical receiving set of the 1st invention is characterized by inputting an optical signal, equalizing waveform distortion with said waveform equalizer including the optical filter which separates the upper sideband and lower sideband of optical carrier frequency of this optical input signal, the optoelectric transducer of said upper sideband outputted from this optical filter, or a lower sideband which receives either at least, and the equalizer which undergoes the output of this optical/electrical converter, and obtaining an input signal.
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> The optical filter which the optical receiving set of the 2nd invention inputs an optical input signal, and separates the upper sideband and lower sideband of optical carrier frequency of this optical input signal from this optical input signal. The 1st and 2nd optoelectric transducers which receive the upper sideband outputted from this optical filter, and a lower sideband according to an individual, respectively, it is characterized by equalizing waveform distortion with said two waveform equalizers, and obtaining an input signal including the 1st and 2nd waveform equalizers which undergo the output of these 1st and 2nd optoelectric transducers, respectively, and the adder adding the output of these 1st and 2nd equalization filter [sic]. Para. 0007-0008.

In view of the foregoing, Saito teaches equalizing the output of the each optoelectric transducer to compensate for waveform distortion. However, Saito is devoid of any teaching, suggestion or mention of compensating photodetected upper and lower sidebands for both chromatic and polarization mode dispersion, and adaptively equalizing the upper and lower sidebands and adjusting the adaptive equalization in response to a detected bit error rate as called for in amended claim 1. The latter feature is described more detail below.

The Examiner cites Naito for "a method for splitting a received signal into upper and lower sidebands so that dispersion can be compensated using equalizers for the upper and lower sidebands (page 12, lines 19-23)." See Office Action at page 2, ¶2. Naito discloses a phase diversity system in which waveform dispersion of the upper and lower sidebands may be compensated by separate equalization of the signals. As disclosed in Naito:

> In the receivers in the first to third embodiments of the present invention, the electrical 90° hybrid circuit 24 is able to provide the upper sideband signal and the lower sideband circuit separately. Therefore, the wavelength dispersion can be compensated by using an equalizer which gives greater delays for higher frequencies for the upper sideband signal, and an equalizer which gives smaller delays for the lower sideband signal. Page 12, lines 19 – 23.
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> * * * *
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> In the receivers in the first to third embodiments of the present invention, the upper sideband signal and the lower sideband signal are separated from each other on a principle similar to an image rejection principle. Therefore, dispersion in each signal must be compensated by an equalizer to realize phase diversity. Page 12, lines 32 – 35.

As set forth in the previous Amendment, Claim 1, as amended, calls for the steps of "...compensating said photodetected upper sideband signal for chromatic dispersion *and polarization mode dispersion* [and] compensating said photodetected lower sideband signal for chromatic dispersion *and polarization mode dispersion...*" Emphasis added. Neither Saito nor Naito address the issue of polarization mode dispersion (PMD) in any way. PMD is not waveform dispersion. PMD is described in the specification as follows:

> Light signals in an optical fiber actually travel in two planes at right angles, or orthogonally to each other with each axis representing a polarization mode. Typically, one thinks of the two axes being the x-axis and the y-axis. In a perfect optical system, light in each polarization mode travels down the fiber at the same speed. Due to impurities, strains and imperfect symmetry in actual fibers, the polarization modes travel through the fiber at different speeds, causing relative delay. That is, the two polarization modes arrive at different times, which degrades the performance. The result of dispersion is to limit the transmission distance or the

> bandwidth that a fiber may provide. The greater the signal frequency spectral width the higher the penalty.
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> PMD is statistical in that the causes of PMD are not predictable and PMD varies over time. Fibers inherently contain some amount of anisotropy owing to an accidental loss of circular symmetry during fabrication. This loss occurs either through a non-circular waveguide geometry or a non-symmetrical stress field in the glass. In either case, the loss of circular symmetry gives rise to two distinct polarization modes with distinct phase and group velocities. For example, if the core or a section of the core is non-circular, for example, oval, then one of the polarization modes becomes slower than the other.
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> Additionally, the necessarily different chemical composition of the core relative to the cladding in a single-mode fiber usually results in [a, sic] slightly different thermal expansion coefficient for the two regions. This variation gives rise to radially-directed stresses when the fiber is cooled after being drawn during fabrication. These stresses depend on the temperature of the fiber.
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> Birefringence an also be created in a fiber when it is subjected to external forces in handling or cabling, such as bending, microbending or twisting of the fiber, however slight. This again would lead to a change in the refractive index of one of the polarization modes, causing one mode to be slower than the other.
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> The differential phase velocity induced by the birefringence can limit the bandwidth of a fiber by broadening pulses. The PMD is the differential group velocity that is defined by a group-delay time per unit length between the two modes. As explained above, the transmission properties of the optical fibers typically vary with ambient temperature. In practice, this manifests as a random, time-dependent drifting of the state of polarization at the output of a fiber or, in the case of PMD, as random time-dependent fluctuations in the bandwidth of the fiber. Page 3, line 9 – page 4, line 11.

Applicants respectfully disagree with the Examiner's assertion that because Naito discloses equalizing chromatic dispersion compensation, "the structure of the combination of Saito and Naito et al. is capable of performing PMD compensation since Naito et al. teaching [sic] comprises polarization splitting of the received optical signal followed by delay equalization." See Office Action at page 14, ¶9. The phenomenon of PMD and a means for compensating for PMD

are neither addressed nor suggested by Naito. Nevertheless, Applicants have further amended the claims to further distinguish the claimed invention from the combination of Saito and Naito.

With reference to the Fig. 6 of the drawings of the instant application, a diversity receiver 600 in accordance with an aspect of the present invention comprises adaptive equalizers 655, 660 that include variable gain amplifiers and variable delay filters as shown. Output signals from the adaptive equalizers 655, 660 are combined in the summation circuit 668 and the bit error rates of the output signals are detected in the QBER monitor 670. The results detected in the QBER monitor 670 are communicated to a microprocessor which adjusts an amplification factor of the variable gain amplifiers in the adaptive equalizers 655, 660, or adjusts the amount of delay of the variable delay filters to optimize the quality of a received signal. Representative independent claim 1, as amended, incorporates this feature.

Neither Saito nor Naito, either taken alone or in combination, teaches or suggests the steps of "photodetecting *and adaptively equalizing* said upper sideband; photodetecting *and adaptively equalizing* said lower sideband... *detecting a bit error rate* of the resulting combined signal; and *adjusting the adaptive equalizing according to the bit error rate*." Emphasis added. Saito merely discloses that waveform distortion in the upper and lower sidebands is equalized utilizing first and second waveform equalizers. See Saito at ¶¶0007-0008. Naito similarly discloses the use of first and second equalizers 26, 28 for equalizing the upper and lower sidebands. However, neither reference contains any teaching, suggestion or mention of adaptively equalizing the signals and adjusting the adaptive equalization according to a detected bit error rate. Accordingly, it is respectfully submitted that even if, assuming *arguendo*, Saito and Naito are properly combinable; such combination would not reach the invention of independent claim 1. It is further submitted that independent claims 23 and 27 (which contains the same limitations) and those claims dependent on claims 1, 23 and 27, are patentable over the combination of Saito and Naito for the same reasons.

Claims 5, 15, 18 and 24 stand rejected under Section 103(a) as being unpatentable over Saito in view of Naito as applied to claims 1, 4 (cancelled), 6-9, 12-14, 16, 17, 19, 23, 25 and 26 above, and further in view of Kumar (U.S. Published Patent Application No. U.S. 2001/0050926 ("Kumar"). Applicants hereby reiterate the above argument distinguishing the claimed invention from Saito and Naito, and submit that the addition of Kumar fails to remedy the deficiencies in the disclosures of Saito and Naito.

Kumar discloses the use of a "diversity selector" 241 for determining which codewords of an upper subcarrier signal and a lower subcarrier signal to select based on a pair of upper and lower subcarrier signal codeword estimates. See Para. 0181. However, Kumar is completely silent with respect to compensating for PMD in an optical fiber system and adaptively equalizing the signals and adjusting the adaptive equalization according to a detected bit error rate as explained above. Accordingly, it is respectfully submitted that Kumar fails to remedy the deficiencies in the disclosures and combination of the Saito and Naito references, and that even if, assuming *arguendo*, these three references are properly combinable, such combination would not reach the claimed invention.

Claims 10 and 11 stand rejected under Section 103(a) as being unpatentable over Saito in view of Naito as applied to claims 1, 4 (cancelled), 6-9, 12-14, 16, 17, 19, 23, 25 and 26 above, and further in view of Duck U.S. Patent No. 6,040,932 ("Duck"). Applicants hereby reiterate the above argument distinguishing the claimed invention from Saito and Naito, and submit that the addition of Duck fails to remedy the deficiencies in the disclosures of Saito and Naito.

Duck discloses a system and method for demultiplexing closely spaced optical channels carrying optically encoded data. Duck is completely devoid of any teaching or suggestion of compensating for PMD in the upper and lower photodetected sideband signals and adaptively equalizing the signals and adjusting the adaptive equalization according to a detected bit error rate as called for in the instant claims. In fact, the sections of Duck cited by the Examiner are not even directed to a photodetected signal. In these sections, Duck states:

> FIG. 11a shows a sub-system using a 50/50 splitter to divide the input optical signal between two optical fibers. In the upper optical fiber, two etalons 116 transmit only light of wavelengths λ2, λ4, λ6, and λ8. In the lower fiber, two etalons 116a transmit only λ1, λ3, λ5, and λ7.
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> FIG. 11b shows an alternate configuration where the reflected signal from 116 is used to obtain λ1, λ3, λ5, and λ7 eliminating the 3 dB loss of the 50/50 splitter. As shown the reflected signal is captured in a separate optical fiber. Alternatively, an optical circulator may be used. Col. 7, lines 31 – 40.

Thus, Duck fails to remedy the deficiencies in the disclosures of Saito and Naito, and it is respectfully submitted that even if, assuming *arguendo*, these three references are properly combinable, such combination would not reach the claimed invention.

Claim 20 stands rejected under Section 103(a) as being unpatentable over Saito and Naito as applied to claims 1, 4 (cancelled), 6-9, 12-14, 16, 17, 19, 23, 25 and 26 above, and further in view of Sun et al. ("Tunable RF-power-fading compensation of multiple-channel double-sideband SCM transmission using a nonlinearly chirped FBG"; Sun et al.; Photonics Technology Letters, IEEE, Vol. 12, Issue 5, May 2000, Pages 546-548)("Sun"). Applicants hereby reiterate the above argument distinguishing the claimed invention from Saito and Naito, and submit that the addition of Sun fails to remedy the deficiencies in the disclosures of Saito and Naito.

Sun discloses "the use of a nonlinearly chirped [fiber Bragg grating] FBG to compensate *tunably* for dispersion-induced RF power degradation in *multiple – channel* [digital subcarrier-multiplexed] SCM transmission links and reconfigurable networks." See page 546, col. 2, lines 7 – 10. However, Sun is completely devoid of any disclosure or suggestion of compensating for PMD in the upper and lower photodetected sideband signals and adaptively equalizing the signals and adjusting the adaptive equalization according to a detected bit error rate as called for in the present claims. Accordingly, it is respectfully submitted that Sun fails to remedy the deficiencies in the disclosures of Saito and Naito, and

that even if, assuming *arguendo*, these three references are properly combinable, such combination would not reach the claimed invention.

Claims 20 and 21 stand rejected under Section 103(a) as being unpatentable over Saito in view of Naito as applied to claims 1, 4 (cancelled), 6-9, 12-14, 16, 17, 19, 23, 25 and 26 above, and further in view of Nielsen et al. U.S. Patent No. 6,559,988 ("Nielsen"). Applicants hereby reiterate the above argument distinguishing the claimed invention from Saito and Naito, and submit that the addition of Nielsen fails to remedy the deficiencies in the disclosures of Saito and Naito.

Nielsen discloses "an optical wavelength add/drop multiplexer (WADM) [which] is configured to add or drop two or more signals each associated with one of a plurality of channels in a wavelength division multiplexed (WDM) signal. Although Nielsen teaches the use of fiber Bragg gratings for filtering optical wavelengths, this reference does not disclose or suggest individually processing upper and lower sideband signals for PMD compensation and adaptively equalizing the signals and adjusting the adaptive equalization according to a detected bit error rate. Accordingly, it is respectfully submitted that Nielsen fails to remedy the deficiencies in the disclosures of Saito and Naito, and that even if, assuming *arguendo*, these three references are properly combinable, such combination would not reach the claimed invention.

Claims 22, 27 and 29 stand rejected under Section 103(a) as being unpatentable over Saito in view of Naito as applied to claims 1, 4 (cancelled), 6-9, 12-14, 16, 17, 19, 23, 25 and 26 above, and further in view of Djupsjobacka U.S. Patent No. 6,337,756 ("Djupsjobacka"). Applicants hereby reiterate the above argument distinguishing the claimed invention from Saito and Naito with respect to independent claim 1, and submit that the addition of Djupsjobacka fails to remedy the deficiencies in the disclosures of Saito and Naito.

Djupsjobacka discloses an optical duobinary transmitter system and method, which comprises:

> an input terminal, a driving circuit, a double electrode optical modulator, particularly of the Mach-Zehnder type, and an output terminal.

> The input terminal is arranged to receive a first binary signal and the driving circuit, which is connected to said input terminal, is arranged to convert the first binary signal into a second and a third binary signal. The double electrode optical modulator is connected to the driving circuit in such a way that its upper and lower electrode may be driven by said second and third binary signal, respectively, said modulator being further arranged to modulate the amplitude and phase of an optical carrier according to the binary driving signals so as to provide an optical duobinary signal corresponding to said first binary signal and with a predetermined negative modulation chirp parameter. Finally, the output terminal, which is connected to the optical modulator, is arranged to feed an optical transmission line with the modulated optical duobinary signal. See Col. 3, lines 14 – 32.

Djupsjobacka, however, fails to teach, suggest or mention anything about PMD compensation and adaptively equalizing the signals and adjusting the adaptive equalization according to a detected bit error rate. Accordingly, it is respectfully submitted that Djupsjobacka fails to remedy the deficiencies in the disclosures of Saito and Naito, and that even if, assuming *arguendo*, these three references are properly combinable, such combination would not reach the claimed invention.

Claim 28 stands rejected under Section 103(a) as being unpatentable over Saito in view of Naito, and further in view of Djupsjobacka as applied to claims 22, 27 and 29 above, and further in view of Kumar U.S. Published Patent Application No. U.S. 2001/0050926 ("Kumar"). Applicants hereby reiterate the above argument distinguishing the claimed invention from Saito, Naito and Djupsjobacka with respect to claims 22, 27 and 29 above, and respectfully submit that the addition of Kumar fails to remedy the deficiencies in the disclosures of the previous three references. Kumar fails to teach, suggest or mention anything about PMD compensation of upper and lower sidebands and adaptively equalizing the signals and adjusting the adaptive equalization according to a detected bit error rate as discussed at length above. Accordingly, Kumar does not remedy the deficiencies in the disclosures of the prior three citations and therefore even if, assuming *arguendo*, these *four* references are properly combinable, such combination would not reach the claimed invention. Applicants also respectfully

contend that the Examiner has failed to demonstrate that there exists any suggestion or motivation for one skilled in the art to combine these four references and that Applicants' claims are essentially being used as roadmap to pick and choose features in the prior art.

In view of the foregoing, Applicants respectfully submit that claims 1 and 5-29 are patentable over the cited art and allowance of these claims at an early date is solicited.

The Office is hereby authorized to charge any additional fees or credit any overpayments under 37 C.F.R. 1.16 or 1.17 to AT&T Corp. Account No. 01-2745. The Examiner is invited to contact the undersigned at (908) 707-1573 to discuss any matter concerning this application.

Respectfully submitted,
Alan H. Gnauck, et al.
By:

Date: 3/29/05

Gary H. Monka
Registration No. 35,290
Attorney for Applicants

Canavan & Monka, LLC
250 State Route 28, Suite 207
Bridgewater, New Jersey 08807
(908) 707-1573